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## AI AT BANKING INFRASTRUCTURE

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## ШТУЧНИЙ ІНТЕЛЕКТ У БАНКІВСЬКІЙ ІНФРАСТРУКТУРІ

**Abstract.** Efforts for better services are achieved by small steps such as analyzing data of the customer. What is significant for the customer should as well significant for the banking institution. Transparency and a better understanding of the pattern behavior of customers can be used for the good of both partners such as good relationships in the future eventually be beneficial for the customer as well as a banking institution. The responsibility of both sides is crucial to understand the accountability of customers and banking institutions. The method of identification of user messages of the banking application proposed in the article involves the use of user data for information processing, taking into account the peculiarities of the use of mobile devices and the user's dialogue with bank messages. Also, the proposed method allows you to rank messages to identify the most important messages and get the desired result by providing effective recommendations in favor of each of the participants in customer interaction with the bank. The introduction of modern educational programs "Information Control Systems and Technologies", "Artificial Intelligence Systems" and "Systems Analysis" in the field of information technology, allows users and managers to interact with the bank's customers sufficient information to make informed recommendations for effective management decisions. The article considers the conceptual model of interaction of users and managers on interaction with users of the bank, use of technologies and algorithms of artificial intelligence, machine learning processes to formalize the process of dialogue, systematization and ranking of messages and notifications between customers and managers. The Conceptual model of interaction of the user of banking services with messages is presented. The article also describes the features of the dialogue between the user of banking services and the manager for the implementation of algorithms for interaction with customers. The example of the city block of bank users considers and takes into account the difference in the amount of information received by the bank, which must be sent during different periods of the week and take into account the amount of information to be sent, which will be significantly less and, consequently, the number of necessary services. will also be smaller. In this example, taking into account the amount of information that can be consumed during different periods of the week, the number of services that can be provided to the user will also be much smaller. The reflection of such interactions in the model is an important aspect, as noted in the article.

**Keywords:** Artificial Intelligence (AI); Machine learning (ML); Banking services; Banking institutions; AI projects; Human Recognition Algorithms; Neural network.

**Анотація.** Зусилля з метою надання кращих послуг досягаються маленькими кроками, такими як аналіз даних користувача. Те, що є важливим для користувача, також має бути важливим для банківських інституцій. Відкритість та краще розуміння патернів поведінки клієнтів, яким надається банківська послуга, має бути використана з хорошими намірами для обох сторін, така взаємодія в майбутньому вигідна для обох сторін. Відповідальність обох сторін є важливою для розуміння відповідальності клієнта й банківських інституцій. Запропонований у статті метод ідентифікації повідомлень користувача банківського додатку передбачає накопичення та оброблення даних користувачів по спеціалізованим алгоритмам з використанням технології штучного інтелекту, врахування особливостей використання мобільних пристроїв та діалогу користувача з повідомленнями банку. Запропонований метод дозволяє ранжувати повідомлення для виявлення найбільш важливих повідомлень та отримувати бажаний результат за рахунок надання ефективних рекомендацій на користь кожного з учасників взаємодії клієнтів з банком. Впровадження сучасних освітніх програм в ДВНЗ «Київський національний економічний університет імені Вадима Гетьмана», зокрема «Інформаційні управляючі системи та технології», «Системи штучного інтелекту», «Системний аналіз» в галузі інформаційних технологій, дозволяє випускникам надавати знання для створення прикладних систем штучного інтелекту в банківській сфері, що забезпечує користувачам та менеджерам новітні підходи по взаємодії з клієнтами банку та виважених рекомендацій для прийняття ефективних управлінських рішень. У статті представлено концептуальну модель взаємодії користувачів та менеджерів банківських послуг на основі технології оброблення інформації з повідомленнями, використання технологій та алгоритмів штучного інтелекту, процесів машинного навчання для формалізації процесу діалогу, систематизації та ранжування інформації з повідомлень та сповіщень між клієнтами та менеджерами банку. Також описані особливості діалогу користувача банківських послуг та менеджера по реа-

лізації алгоритмів взаємодії з клієнтами. На прикладі міського будинку користувачів банку розглянута та врахована необхідність надсилати бажану кількість інформації. Така відмінність у кількості та потребі отриманої інформації надсилання впродовж різних періодів тижня була взята до уваги, що надає можливість суттєво збільшити ефективність надання послуг і, як наслідок, кількість послуг всім клієнтам банку також буде більшою. Розглянутий приклад враховує ту особливість, що обсяг інформації збільшується з урахуванням можливості його опрацювання клієнтом банку, як під час вихідних, так і в будні дні. Із урахуванням у статті особливостей взаємодії користувачів з банком, з'являється можливість надавати більшу кількість послуг. Як було зазначено в статті, відображення такої взаємодії в моделі становить важливий аспект.

**Ключові слова:** штучний інтелект (ШІ); машинне навчання (МН); банківські послуги; банківські інституції; проекти з використанням штучного інтелекту; алгоритми розпізнавання людей; нейронна мережа.

## Introduction

Customers and banking institutions are connected together in order to achieve a better quality of life and future benefits for both. Due to the usage of everyday technologies, such as notifications, the customer will receive better services, at the correct time. Understanding those simple principle for both sides is crucial, due to the nature of customers and bank as a services provider.

## Formulation of the problem

Find out the right amount of data that is needed in order to obtain information about services and patterns of behavior.

## Recent research and publications

*Banking cyber security management system using artificial intelligence.* Article about a sufficient level of security in banking systems. The technology is quite simple and has proven itself for several decades. Potential attackers are rapidly moving forward and to ensure the technological advantage of the bank's security service, the article proposes the use of three-dimensional video in combination with human recognition algorithms for movement, and clothing attributes to further use artificial intelligence to analyze and recognize real-time images and space in the bank.

International collective monograph: Modern problems of modeling of social and economic systems / According to the results of the XII International scientific-practical conference »April 9-10, 2020 Conference MPSESM-XII, Bratislava-Kharkiv-2020, International electronic edition CEUR Workshop Proceedings (SCOPUS).

## The subject of the study

The amount of data that is needed to analyze behavioral patterns of bank customers.

## Content of the article

People fear being replaced by AI and losing their jobs. In order to make the transition to adoption of AI technology more smooth, starting with an augmented intelligence approach can be powerful. As opposite of human AI powered chatbot can interact with customers 24/7 breaking down the idea of traditional banking hours. When serving members all over the world, this is very important. Customers are becoming increasingly comfortable conversing with chatbots for a variety of things making this a logical next step for the bank to invest in.

AI is now starting to allow the bank to provide more personalized insurance offerings depending on where customers live, know if they will be coming back from a deployment soon and offering various services to help them transition home, and other personal offerings. Without AI, this just can't be achieved at scale. The bank still has a ways to go before true hyperpersonalization is achieved, but internal discussions continue about the best path forward.

Storage and banking data management are two areas where AI will reduce the costs of storing more data, increase the speed of accessing it and reduce the managerial burdens around compliance, making data more useful on many fronts.

One of the biggest challenges in using AI tools in storage and data management lies in identifying and rectifying gaps between observation and actions. For example, IT will face challenges in order to lower cost, while also keeping the data online, transactional and performant for the business. Infrastructure software, such as databases, have traditionally not been very flexible [3].

Most modern AI projects are powered

by machine learning models. Building machine learning models is a time-consuming process, but it can be sped up with the help of automated machine learning. For example, data scientists often spend considerable time translating data into different structures and formats and then tuning the neural network [10] configuration settings to create better machine learning models [4].

For several decades, banking infrastructure remains the same. So eventually it became a place where artificial intelligence should be implemented in order to help reduce the cost or necessity of human interaction. Services which banks should provide for the majority of people continually adapted the latest technology innovations to redefine how customers interact with them. Banks introduced ATMs in the 1960s and electronic, card-based payments in the '70s. The 2000s saw broad adoption of 24/7 online banking, followed by the spread of mobile-based "banking on the go" in the 2010s.

Few would disagree that we're now in the AI-powered digital age, facilitated by falling costs for data storage and processing, increasing access and connectivity for all, and rapid advances in AI technologies. These technologies can lead to higher automation and, when deployed after controlling for risks, can often improve upon human decision making in terms of both speed and accuracy. The potential for value creation is one of the largest across industries, as AI can potentially unlock \$1 trillion of incremental value for banks, annually. [1]

Customers who need services and visit the banks expect to get a good quality of service, it means that some amount of human labor is needed in order to keep it ready for the customers and meet customers' rising expectations and beat competitive threats in the AI-powered digital era, the AI-first bank will offer propositions and experiences that are *intelligent* (that is, recommending actions, anticipating and automating key decisions or tasks), *personalized* (that is, relevant and timely, and based on a detailed understanding of customers' past behavior and context), and

truly *omnichannel* (seamlessly spanning the physical and online contexts across multiple devices, and delivering a consistent experience) and that blend banking capability with relevant products and services beyond banking. [1].

As a part of the financing life, banking services are as much needed as the main source of financial stability, let's take a look at the personal life of citizenship in the city. The payment process at every step of modern life, starting with the transport fee. A variety of different providers such as uber, uklon, bolt give us a slight view about the usage of banking payment method. Customers can choose over different providers and this information can be important for machine learning models for a better understanding of behavior. As customers approach a location where further transportation is needed banking applications at the mobile device can give a slight view of the possible next location. When the person buys a ticket to the cinema it's obvious that at the beginning of the movie person will travel to cinema building so it might be a good chance for the company who offer the transportation services to have the vehicles nearby. When a transportation company has a deal with a bank, over the usage of private data it obvious that the personal data can be shared for a better user experience, there is nothing wrong with personal information which can be known by a bank or transportation company. As a matter of fact, we live in an open world, which means that every movement can be tracked by the software on mobile devices. Taking into account that western citizenship is open and have nothing to hide, sharing that information with a bank [5] or transportation company[4] can have even advantages for a person from a legal perspective.

Using data by the company of financial institutions such as a bank can significantly reduce the necessity of human interaction over everyday usage of modern services such as transportation. Another good example of the advantages of using modern software can be implemented by the urban railway system.

Instead of using transportation company a lot of citizenship use urban rail as a daily method of transportation, using those data in order to improve the city infrastructure is an advantage over the previous form of manual predication. The daily route from home to work is actually changed by a mobile application, which gives the possibility to increase the comfort of a person who uses banking software. That movement from point b to point a can be predicted [6] by using the history of the movement [7] and everyday usage, as an example during the early hours of the cycle of movement cart should be reduced by minutes. That estimation, of how exactly reduce the cycle can be made by using the data [8] of mobile devices, during that period of time when it is needed the number of carts can be increased, and during the afternoon cycle can be increased or event stopped if there is no necessity for the transportation system. Those examples show us that mobile data can be used in order to reduce the cost of electricity during that period of time when there is no necessity or increase the comfort of citizenship during that period when the transportation system is needed.

We already cover the necessity of using mobile data in the form of predicting personal movement and using the services of transportation system at the city, so a lot of things can be achieved by the digitalization of data proceeding at the level of banking software. It means that person can achieve more than comfort or way of transportation from point b to point a, so let's talk about the next level of consumption services from the banking perspective. The person who trusts his data to bank, we are talking about a socially responsible bank, receive those things which are necessary for a comfortable life, as an example the way of transportation in a city without any additional problem such as traffic jam or disruption or even services failure. The person for the bank is a customer who gets services and generates a profit for the bank, and it is important for both sides to understand that the next level of consumption is possible only after the understanding of how society

works, in order to be much efficient. It is important for the next level of consumption, understand that resources are limited in a way that a small portion should give more outcome for an even bigger society. Those two factors can work together in the hand of people who are responsible for the future of the country. Countries can move forward only by using such an instrument as modern banking software. Better education and better knowledge especially during the first phase of responsible life will eventually explain this part of coordination.

Implementing even a small portion of those innovations requires technical knowledge of AI and ML. It might be challenging to attract sufficient personnel possessing these specific skills. At Board of directors' level, sufficient knowledge should be present, enabling the Board to assess the risks of AI [9]. Second line personnel should be trained to understand AI specific challenges and risks. Personnel working with AI applications should be made aware of the strengths and limitations (Van der Burgt 2019).

When there is some or full automation of the process from data gathering to decision making, human oversight is essential. This becomes more necessary as the level of automation rises, or when ML techniques become more prescriptive.

When taking all of the risks mentioned above into account, it seems apparent that the use of AI and ML techniques also brings about extra challenges in the context of the common ambition of integrated risk management within banks. Use cases being dispersed throughout different parts of the bank could hinder integrated risk management and an integrated approach towards these risks. [2]

The next generation of technic can be implemented even today with a better understanding of technology which powered those aspects of life as consumption of banking services. Another important part of customer consumption is health care products such as medicine. In order to prevent or even help, the bank can integrate the system of health care data of the patient with his ability to buy

the medicine. Average health care coverage is highly influenced by the decision of how much medicine the person can buy, it's important to make medicine more affordable for the majority of people who also, as a matter of fact are the customer of the bank. During the time which can be crucial for citizenship, in order to overcome the recession or bad financial period of economic development decision made by artificial intelligence when the history of person was taken into account can be much effective. In such a way that personal lives are taken into account as a value for the bank. Such significant changes of bank position in the life of the person have even more significant influence on the bank as an institution. The ability to pay for medicine can be calculated at the beginning of the process. At the first stage person who is responsible for his life and the life of his family should have trust for the institutions of the financial system.

Trust can be evaluated by some criteria such as the number of customers, who subscribe for services as well as their evaluation of the level of the services. As an example, nice looking first floor of the banking department can increase the level of evaluation a lot. Those things as nice looking banking department or even the main department currently is achieved by human efforts, that means that level of service quality can be different from time to time, especially it matters when a huge number of people visit the banking department, due to the reason of inability to provide service of cleaning at the middle of the day, banking department can look really bad at the end of the day. It will be nice to have a good quality of service without the necessity of human interaction this can be achieved by using the pattern and behavior of customers as well as a good machine learning model [12]. Such a model can have a lot of criteria taking into account some of the most important. First of all, it is a potential visitor at the end of the day. Fully understanding that the schedule of cleaning is important for not only evaluation but as well as the health of the visitors, changing schedule in order to

have a customer who is healthy after visiting the banking department is beneficial for the customer as well for the bank as an institution. No matter what, we all are human at the end of the day, the customer, as well as staff of the bank, should have a nice impression about each other, it is beneficial for both sides. We can argue about the level of quality that can be provided by automated services, the true side of this remain the same clean and healthy environment is a crucial part of the banking environment, from the perspective of the future relationship between customer and banking institution who provide necessary services for people.

Another good example of using AI and ML can be shown as part of the banking department at the vehicle, its function is almost impossible without using mobile software of the bank. The main problem with this type of communication is the possibility to meet the client at the exact time. Due to the planning of the movement, such a way to provide services became a really important couple of years ago. When the potential client and bank as a service provider have necessity to meet in order to cover the necessary service, such as the distribution of bank currency across the country, the only way to do this effectively by using ML as a platform for the more effective provider of distribution services. A lot of problems can be resolved by the effective created model, such as the necessity of distribution as well as the right amount of necessary payments at different cities and villages. More important than providing distribution of currency can be the distribution of goods across the country, by using such information about customers from their mobile devices. In such a way distribution of goods as well as the distribution of services can be organized by AI by using a good model from the client's data. Such kind of innovation can be achieved by a simple goal, such as level of service coverage. Let's take a look at such advantages from the perspective of the customer, goods, and services which should be bought in order to have a healthy life will be bought at the end of the month, but without



using AI it will be not so efficient. In order to make it more efficient for the customer, data and events can be used as a pattern for ML [11]. Such usage of human interaction with a mobile device will remain the same, but the quality of service will be significantly higher, due to the principal that was mentioned, such as social responsibility and understanding of the future necessity of using services. As we already mentioned about banking services that are needed for the customer as well as the customer who will consume these services, in one way or another, banking institutions will remain the same. Such stability of provided services are important for the good function of the society, as long as this institution will remain the balance and good care of each other country will be as strong as a rock.

Analyzing banking services by it necessary for the customer is important in the way which all aspects of human lives in sum way depend on the usage of payment method can give another interesting discovery about the customer and their decisions. Such information can be used as the next level of achievement of social equilibrium. By using information about tax payments from banking institutions law enforcement officers can have a slight view about the activity which is made by the customer, some part of such restriction already are implemented. Those predictions about the activity of customers are part of social responsibility which is a necessary aspect of society. Achieve this responsibility is possibly by using AI as a decision maker, not only for the customer but also for law enforcement are important to know about spending which are made by politician, who happens to be also is the customer of the bank. The transparency that is a key value of modern society can and should be achieved by ML patterns such as which hospital is used, not as an address at the map but as a level of service, is this hospital affordable for a lot of citizenship, if not question remain the same. Technology is not the key, it is a tool for achieving such things as good quality of life, and to be sure at the beginning of those transformations are banking infrastructure, as well

as physical as well as software. Open information in a such way that it can't be used against the person, but instead be used for better quality of life and also for better decision of citizenship, who provide support for the institution as well as for the state. It is an important part of everyday life that can become better or worse as the results of our choice, such as banking services or access to the data.

Processing a huge amount of data can be not an easy task, let's calculate how much data can be produced by the customer of the bank. The typical day begins by receiving updates on mobile devices about propositions from the market or some interesting advertising. It's a small portion of a couple of bytes, which is not significant for the modern device, but so important for data scientists. The table which is named "Amount of data for the customer" presented the following value number of devices (*D* at table 1), amount of data which is important for the customer (*S* at table 1), amount of data which customer are not interested in (*N* at table 1).

Table 1. Amount of data for the customer

<i>D</i>	<i>50</i>	<i>100</i>	<i>150</i>
<i>S</i>	0.08Gb	0.15Gb	0.25Gb
<i>N</i>	0.04Gb	0.08Gb	0.17Gb
<i>Total</i>	0.12Gb	0.23Gb	0.42Gb

From table one we can better understand which amount of data can be generated by a small city block during a different period of time such as a weekend or working day. The amount of data can be different at different periods of time. It is important information in order to analyze activity by the customer, their interest, and probable future behavior during the day as well as choices made by the customer. By not paying attention for the message the customer will not know or even chose the services, such a pattern that was learned by AI at the middle of the day are important for banking department as well as, another service provider so the better qua-

lity can be provided by banking infrastructure as well as the customer who will receive better services, which is important for health as well as for better decision making. When the customer opens the mobile notification it is obvious that the customer is interested and can make a decision, after opening some portion of the notification customer can lose interest, for data scientists this type of behavior is a changing point of how much notification the customer can read in order for more important notification be placed exactly at the place where data scientist should know the changing point. By analyzing such behavior for a month or even a couple of weeks by using the ML, the data scientist can produce a good model for better consumption.

### Summary

The article where present a vision about the usage of customer data. Such a small portion of everyday life can be significant, in order to change the role of the banking institution. The city block is a crucial part of every city, understanding of human behavior and interaction with notification where presented as a result of interaction with not one but at least ten and more. Also where discovered that effort to increase the attention of a customer small portion of none important notification can be added. Such a principle of customer interaction with mobile devices should be used for the creation of new services and more important services for the customer.

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